Matrices:

$$I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix},\ R = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix},\ P = \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix},\ A = \begin{pmatrix} \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{pmatrix},\ D = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$$

Vectors:

$$T = \begin{pmatrix} 2 \\ 0 \end{pmatrix},\ V = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

Multiplying by a matrix: Multiply the rows of the matrix by the column of the vector (or columns of the other matrix).

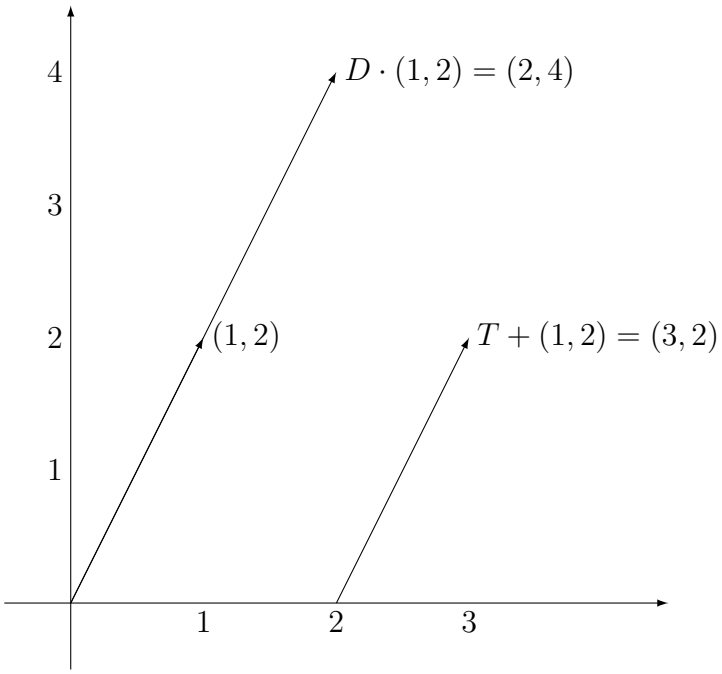
$$\begin{aligned} D \cdot \begin{pmatrix} 1 \\ 2 \end{pmatrix} &= \overrightarrow{\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}} \cdot \begin{pmatrix} 1 \\ 2 \end{pmatrix} \downarrow \\ &= \begin{pmatrix} 2 \cdot 1 + 0 \cdot 2 \\ 0 \cdot 1 + 2 \cdot 2 \end{pmatrix} \\ &= \begin{pmatrix} 2 \\ 4 \end{pmatrix} \end{aligned}$$

Adding matrices or vectors: Add term by term.

$$R + P = \begin{pmatrix} 0 & 1 \\ 0 & 1 \end{pmatrix} + \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} = \begin{pmatrix} 0+1 & 1+0 \\ 0+0 & 1+0 \end{pmatrix} = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$$

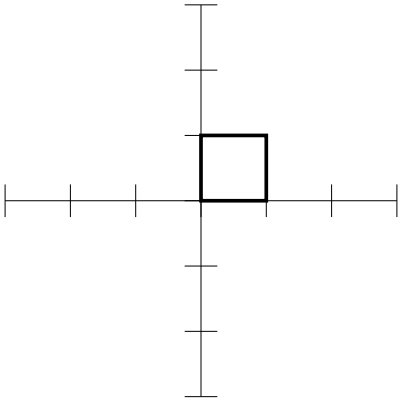
$$T + \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} 2 \\ 0 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} 1+2 \\ 2+0 \end{pmatrix} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$$

Graphical Interpretation:

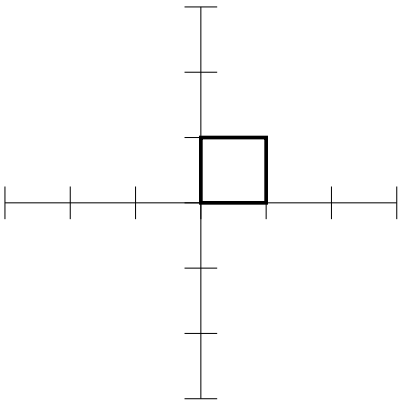


Below are nine graphs with copies of the unit square on them. Label each corner of the square with its coordinates, then treating each corner of the square like a vector carry out the operations listed below and draw result on the graph like the example above.

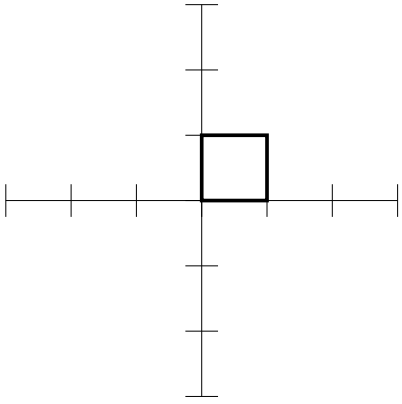
1. $I \cdot$ '*each corner*'



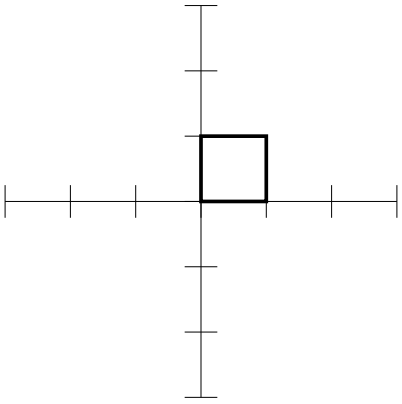
4. $V +$ '*each corner*'



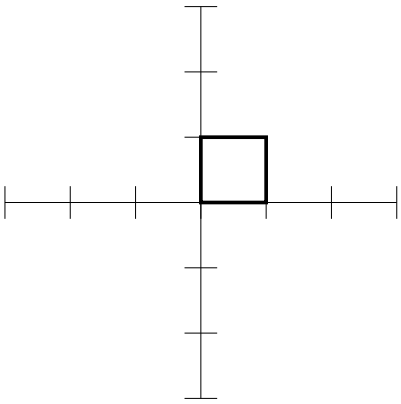
7. $V + T +$ '*each corner*'



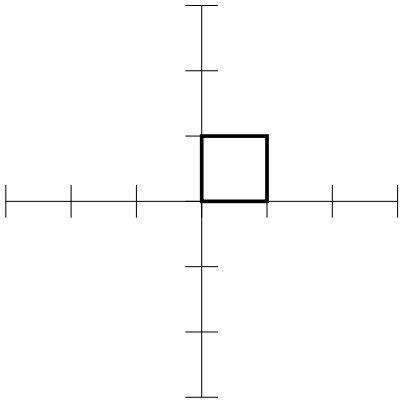
2. $P \cdot$ '*each corner*'



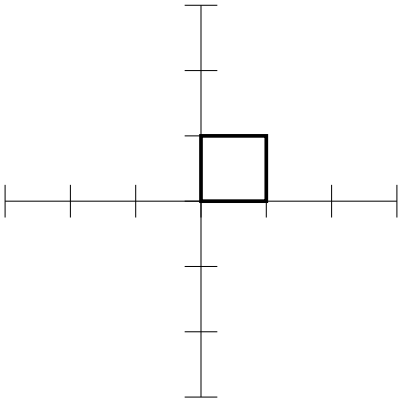
5. $A \cdot R \cdot$ '*each corner*'



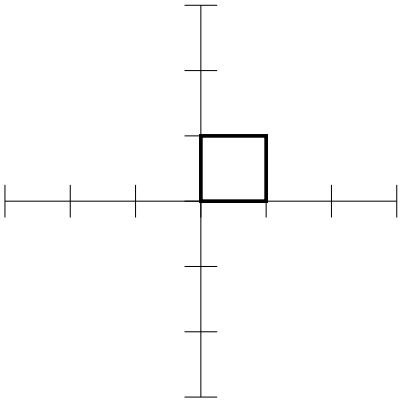
8. $(A \cdot$ '*each corner*'$) + T$



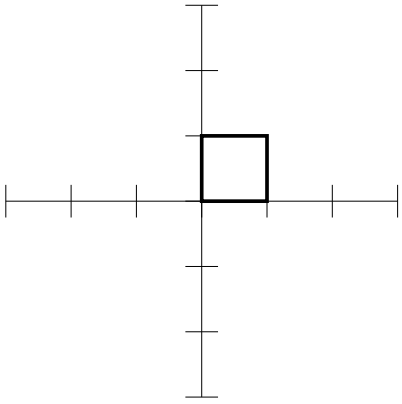
3. $A \cdot$ '*each corner*'



6. $R \cdot A \cdot$ '*each corner*'



9. $A \cdot ($'*each corner*'$ + T)$



Looking at the work you just did describe the effect of each individual matrix or vector operation? What happened when we combined matrices and/or vectors, did the order matter?